U S D A FOREST SERVICE
RESEARCH NOTE RM- 219

ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION

An Initial Assessment of Mammal Damage in the Forests of the Southwest

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Mammal damage is a serious problem in some forests of the Southwest. All size classes of trees are affected, but the problem is most serious in plantations and stands of young trees. In addition, mammals are a major factor in preventing the establishment of regeneration on one-half million acres of nonstocked forest land in the Southwest.

Keywords: *Pinus ponderosa,* mammals, timber management.

One of the greatest problems in the management of ponderosa pine *(Pinus ponderosa)* in the Southwest is obtaining regeneration. Both natural and artificial reforestation measures have frequently been unsuccessful. Although competing vegetation coupled with drought periods at critical times have been most damaging, damage by mammals is an important factor in initial and subsequent survival of young trees (Schubert et al. 1969). Data on the extent of mammal damage are scarce, however.

In an attempt to get at least a qualitative idea of mammal damage to forests in the Southwest, a questionnaire was sent to various forest managers in the summer of 1970. Questionnaires were sent to each Forest Service Ranger District in Arizona and New Mexico, the Grand Canyon National Park, the Bureau of Land Management, the Northern Arizona School of Forestry, and the Mescalero, Navajo, Jicarilla, Southern Ute, San Carlos, Fort Apache, and Hualapai Indian Reservations. Respondents were asked to estimate how many acres of forest trees were being damaged by mammals, which mammals were responsible, and what percentage of the trees on these acres were being damaged. They were also asked, "What is your most serious mammal damage problem?"

As used here, mammal damage is defined as a significant impairment to the initial establishment and subsequent growth of trees. Occasional browsing of seedlings or twigs is not considered to be damage.

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Types of Damage and Mammals Responsible

The problem of mammal damage may begin before the cones are mature on the tree. The Abert squirrel *(Sciurus aberti aberti (Woodhouse)),* which is peculiar to the Southwest, consumes great amounts of ponderosa pine seed. This squirrel does not build caches, but cuts cones from the trees and eats the seed from July 1 to October (Pearson 1950, Larson and Schubert 1970). As much as 25 percent of the cone crop may be destroyed. During the winter months, the squirrel cuts twigs and eats the inner bark (fig. 1). Occasionally trees are so defoliated that they die.

The red squirrel *(Tamiasciurus hudsonicus)* builds cone caches in the transition zone between ponderosa pine and mixed conifer forests. The caches are helpful, however, when it is necessary to collect large amounts of seed.

Squirrels as well as mice *(Perognathus* sp., *Onychomys* sp., *Peromyscus* sp.*)*, rats *(Dipodomys* sp., *Neotoma* sp.*)*, and chipmunks, *(Eutamius* sp.*)* will eat any seeds that fall to the ground. According to Pearson (1950), it is only in exceptionally heavy seed years that there is enough seed left for natural regeneration.

Seedlings that have germinated may be killed by mice, rats, and other rodents gnawing on the stem or cotyledons (figs. 2, 3). Pocket

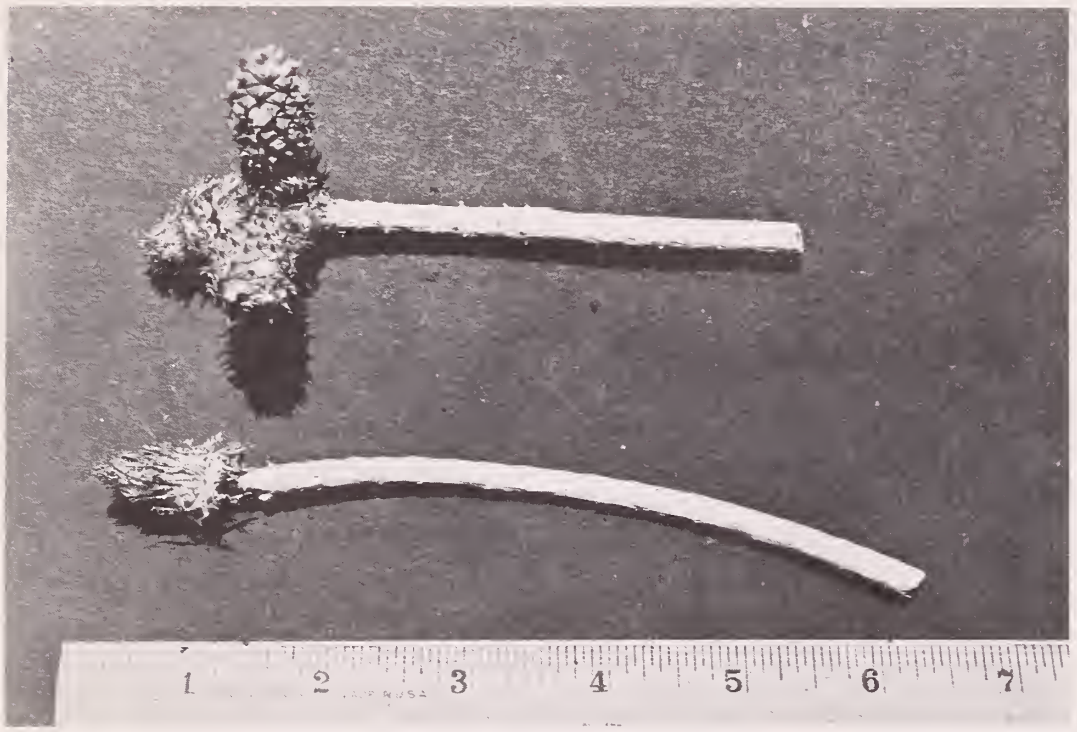

Figure 1.--Twigs clipped from ponderosa pine by an Abert squirrel.

Figure 2.--Young ponderosa pine seedling girdled by a mouse.

Figure 3.--Cotyledons clipped off from a newly germinated ponderosa pine seedling. This damage could have been caused by mice or birds.

gophers *(Thomomys* sp.*)* cause considerable mortality by girdling the tree below the ground line (fig. 4). Gophers may kill trees as large as saplings.

Rabbits *(Sylvilagus* sp.*)* and hares *(Lepus* sp.*)* feed on needles, buds, and bark of small trees. In winter they are able to reach the tops of 4- to 5-foot trees, depending on the depth of snow cover. Rabbit damage is easy to identify because of the characteristic sharp, angled cutting of the stem (fig. 5).

Figure 4.--Seedlings killed by pocket gophers.

Figure 5.--Rabbit damage to planted seedling. Smooth, slanting cut is typical of damage by rabbits and hares.

Porcupines *(Erethizon* sp.*)* may cause heavy damage in stands from seedling to pole and sawtimber size (fig. 6). Smaller trees may be killed, while larger trees are deformed so badly they are unmerchantable.

Damage from trampling and browsing by livestock occurs from the time seedlings are planted or germinated until they are 4 to 5 feet tall (fig. 7). Because livestock can destroy all of the trees in a plantation, they should be excluded for several years, preferably until the trees are out of reach of the animals.

Large mammals such as mule deer *(Odocoileus hemionus)* and elk *(Cervus canadensis)* may also browse trees severely. Browsing usually results in a reduction of growth and poor form, and quite often in death of the tree. Browsing by these animals can be distinguished from rabbit clipping by the jagged appearance of the stem, because these mammals lack upper incisors. When trees are browsed repeatedly it may take several decades before they outgrow the reach of the mammals (fig. 8).

Figure 6.--Porcupine damage in crown of a young pole-sized ponderosa pine.

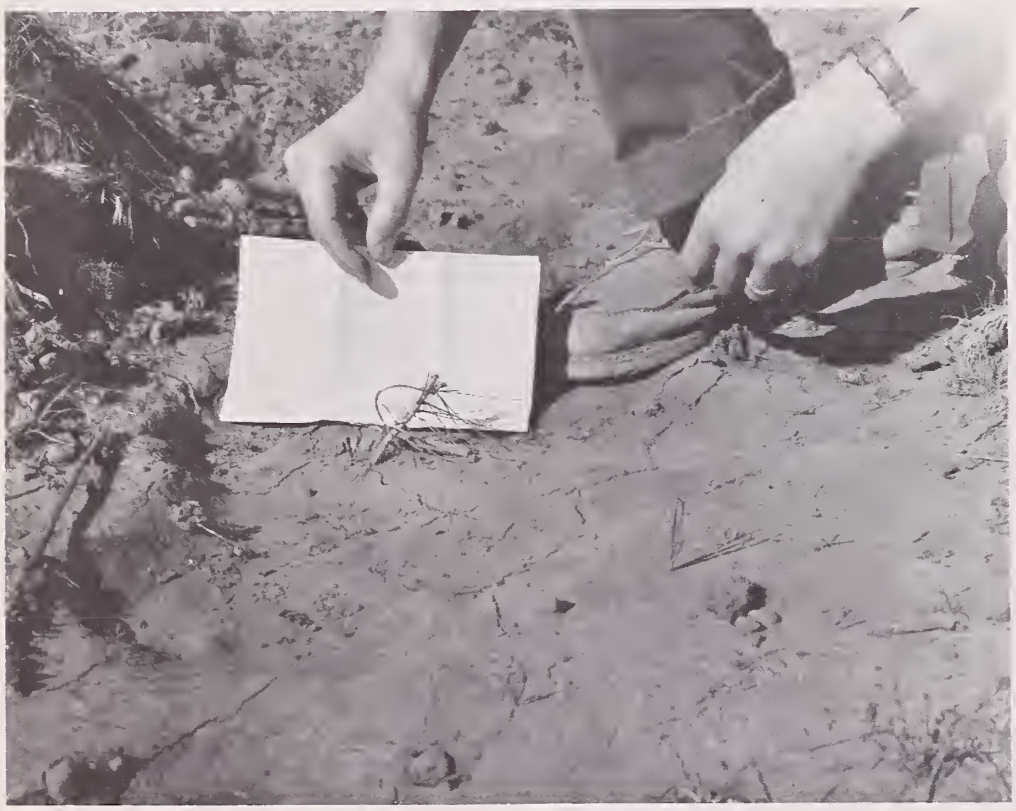

Figure 7.--Ponderosa pine seedling browsed and trampled by cattle. Over 90 percent of the trees in this plantation were browsed.

Figure 8.--Group of ponderosa pine trees which have been repeatedly browsed by deer. All trees in the photograph except the sawtimber in the background are the same age.

Results from the Questionnaire

Over 1 million acres of commercial forest in the Southwest are subject to mammal damage (table 1). Most damage occurs on the 7.5 million acres of commercial ponderosa pine, but smaller areas in mixed conifer stands are also affected. The problem appears to be much more severe in New Mexico than in Arizona. More than half the Forest Service Ranger Districts in New Mexico reported mammal damage problems, compared with approximately one-fourth of the Districts in Arizona. Over 800,000 acres in New Mexico are affected, compared with slightly less than 300,000 acres in Arizona. The most extensive acreages involved in both States support sapling and pole stands, where damage is caused primarily by porcupines (tables 1, 2). Over 600,000 acres of sapling and pole stands are affected, while a third of a million acres of reproduction and a quarter of a million acres of sawtimber are involved.

On the Navajo Indian Reservation, about 100,000 acres of reproduction are subject to damage by sheep. On all other regeneration areas of the Southwest, cattle and sheep can be detrimental to seedling establishment, especially during the first few years after seeding or planting.

On several questionnaires, mice and voles were blamed for regeneration failures. On the Cuba Ranger District of the Santa Fe National Forest in New Mexico, voles destroyed 50 acres of planted stock in 1968. On the Sacramento District of the Lincoln National Forest, also in New Mexico, 55 percent of a tubeling plantation was destroyed by mice.

In Arizona, the most extensive damage in regeneration areas was attributed to gophers and other rodents. On the Chevelon District of the Sitgreaves National Forest, approximately 25,000 acres of regenerated areas are affected by these mammals.

Most of the districts reporting damage stated that from 0 to 25 percent of the trees were affected. On several areas, however, damage was much higher. On the Sacramento District of the Lincoln it was reported that, of 10,000 acres of reproduction, from 50 to 75 percent of the trees were damaged (table 1).

The percentage of questionnaires returned was high. Of the 76 Forest Service Ranger Districts in Arizona and New Mexico, all but seven responded. These seven districts are composed mainly of nontimbered areas. The response from the other agencies was also excellent.

Table 1.--Areas reporting damage and acres of damaged trees, by size classes and percent of damage, in Arizona and New Mexico

Reporting unit	Reproduction			Saplings and poles			Sawtimber			Total, all classes
	0-25%	25-50%	50-75%	0-25%	25-50%	50-75%	0-25%	25-50%	50-75%	
	Acres									
ARIZONA										
(National Forests)										
Tonto										
Payson District	1,000	--	--	--	--	--	--	--	--	1,000
Apache										
Luna	200	--	--	100	--	--	--	--	--	300
Alpine	200	--	--	--	400	--	100	--	--	700
Prescott										
Thumb Butte	300	--	--	--	--	--	--	--	--	300
Sitgreaves										
Chevelon	25,000	--	--	--	--	--	--	--	--	25,000
Lakeside	500	--	--	--	--	--	--	--	--	500
Coronado										
Safford	--	--	--	--	2,000	--	--	--	--	2,000
Kaibab										
Chalendar	50	--	--	--	--	--	--	--	--	50
Williams	200	--	--	--	--	--	--	--	--	200
Coconino										
Blue Ridge	--	--	500	--	--	--	--	--	--	500
Long Valley	--	200	--	100	--	--	--	--	--	300
(Northern Arizona University)										
School of Forestry										
Forest	--	50	--	--	--	2,000	--	--	--	2,050
(Indian Reservations)										
Navajo	50,000	--	--	50,000	--	--	--	--	--	100,000
San Carlos	--	--	--	--	--	--	200	--	--	200
Fort Apache	--	--	--	100,000	--	--	40,000	--	--	140,000
Total	77,450	250	500	150,200	2,400	2,000	40,300	--	--	273,100
NEW MEXICO										
(National Forests)										
Cibola										
Mountainair	--	--	--	4,800	--	--	4,800	--	--	9,600
Magdalena	1,000	--	--	500	--	--	--	--	--	1,500
Lincoln										
Smokey Bear	200	--	--	--	--	--	--	--	--	200
Mayhill	--	450	--	--	--	--	--	--	--	450
Sacramento	--	--	10,000	5,000	--	--	--	--	--	15,000
Gila										
Beaverhead	1,500	--	--	--	--	--	--	--	--	1,500
Wilderness	--	--	--	50	--	--	--	--	--	50
Reserve	--	200	--	--	--	--	--	--	--	200
Santa Fe										
Coyote	50	--	--	--	--	--	--	--	--	50
Cuba	--	--	150	4,000	--	--	--	--	--	4,150
Jemez	50	--	--	--	--	--	--	--	--	50
Pecos	25,000	--	--	50,000	--	--	50,000	--	--	125,000
Carson										
Penasco	--	--	--	700	--	--	--	--	--	700
El Rito	--	--	--[1]	174,250	--	--	--	--	--	174,250
Jicarilla	--	--	--	5,000	--	--	5,000	--	--	10,000
Taos	--	1,500	--	5,000	--	--	4,000	--	--	10,500
Tres Piedras	--	--	--	120,000	--	--	--	--	--	120,000
Questa	200	--	--	--	--	--	--	--	--	200
(Indian Reservations)										
Navajo	50,000	--	--	50,000	--	--	--	--	--	100,000
Jicarilla	[2]50,000	--	--	50,000	--	--	--	150,000	--	250,000
Total	128,000	2,150	10,150	469,300	--	--	63,800	150,000	--	823,400

[1]Includes damage to reproduction that was not separated out.
[2]Percent of trees damaged not reported.

Table 2.--Mammals causing damage and acreage affected

Mammals	Arizona	New Mexico
	- - - - *Acres* - - - -	
Deer and elk	600	20,050
Livestock	51,000	50,200
Porcupine	192,850	728,150
Mice	100	19,450
Other rodents	[1]26,450	50
Bear	2,000	0
Rabbits	100	5,500
Total	273,100	823,400

[1]Most of this damage attributed to gophers and other rodents, which affect 25,000 acres of reproduction on Chevelon District, Sitgreaves National Forest; also includes small amount of damage by beaver.

Discussion

The purpose of this report is not to claim that a million acres of forest in the Southwest are being destroyed by mammals, or that drastic control measures are needed. Rather, it is to draw attention to the fact that, in many instances, mammal damage must be considered in forest management.

This survey does indicate that damage by mammals is a problem in the forests of Arizona and New Mexico. The questionnaire suggests that a third of a million acres of reforested area is affected by mammal damage. There are, however, another half million acres of cut-over and burned land in the region that need reforestation (Schubert et al. 1970). One of the principal reasons that regeneration is lacking on these areas is attrition by mammals (Pearson 1950). Most of the tree seed is consumed by rodents before it can germinate. The seedlings are then subject to attack by all of the mammals mentioned.

Damage to saplings and poles, although occurring over an area of 600,000 acres, is probably not as serious a threat as is indicated by the survey. Many districts reported that the problem is more or less endemic and generally widely scattered. There are localized areas, however, in which porcupines cause heavy damage by girdling all of the trees in a stand.

Sawtimber is probably damaged less severely than the other tree classes since damage is usually limited to the upper crown, and trees are seldom killed.

Obviously, a survey of this type is affected by the biases of the various observers. One Ranger District, for instance, reported that it had no mammal damage problems. Yet the author has conducted numerous planting studies on widely scattered areas of that District, and almost all of them have been partially to heavily damaged by elk, deer, mice, porcupines, gophers, and rabbits, singly or in combination.

In many cases it has not been recognized that mammals are a hindrance to regeneration, since very little effort has been made in the Southwest to reforest nonstocked areas. When an attempt is made to regenerate these areas, the mammal problem is soon discovered.

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